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Introduction

To cope with an increasing population at about 2.8% per year, the Thai government has exerted much effort to increase the rice yield per unit of planted area. The Technical Division, Ministry of Agriculture and Cooperatives, in particular, has tried many approaches to increase the rice yield since 1969. These attempts include the use of better varieties of rice, proper land preparation, adequate amount, proper timing, and application of fertilizer, good water control, and protection against infestation by weeds, pests, and insects. A result of an increase in rice yield up to 1,000 kg per rai (1 rai=0.16 hectare) was expected [3]. However, the actual average rice yield for the whole kingdom was still only 280 kg in 1978 [1]. It may be asked why there is such a big gap between the actual yield and the expected yield despite the wide deployment of extension services. Furthermore, the government set a target of increasing the rice yield at 5% per year by promoting the use of new techniques in the Third Development Plan (1972–1976), but only achieved a 3% increase [2].

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The most important problems related to the increase of the rice yield involve the adoption of new techniques by Thai farmers and the socio-economic constraints which prevented the dissemination of the techniques to the extent expected. Thus the specific objectives of this study are: (1) to identify the environmental constraints which make it difficult to produce the expected yield of rice; (2) to discuss the socio-economic constraints hindering the adoption of the new techniques; and (3) to investigate the effect of government policies and efforts in promoting the new techniques. It is hoped that the findings of this study will contribute to an understanding of the problems facing Thai agriculture and suggest better ways and means to increase agricultural productivity in Thailand.

I Methodology

Sampling

Chanasutr Irrigation Project in the Central Plain was chosen as the site of study because the majority of the population there are farmers who grow both wet and dry season crops, and the fact that the irrigation is very good enabled us to investigate the other variables more easily. A sample of farmers was obtained in three

stages: sampling of the irrigation zones, sampling of the irrigation canals in the chosen irrigation zone, and sampling of the farmers along the sampled canal. Thus 179 farmers were selected. These sample farmers were again divided into three groups: (1) a group with experimental plots, 20 in number; (2) a group without experimental plots but adjacent to them, 60 in number; and (3) a group living far from experimental plots, 99 in number.

Since each sample farm had more than one rice parcel, it was necessary to determine one parcel to obtain detailed production information throughout the growing season. This parcel was called "Intensive Data Parcel." This approach helped save research time and expenditure.

Analysis

After the field survey was completed, descriptive and tabular analyses were primarily used. In order, however, to identify the relative importance of several factors to productivity or adoption of the new techniques, ranking and scaling methods were used. The t-test was also useful sometimes to indicate differences in behavior among the different groups of farmers mentioned above.

II Environmental Constraints on Rice Production

Ranking of Environmental Constraints

The farmers were asked according to their own judgement to rank a list of factors which seemed to have caused the lower than expected rice yield. The findings are presented in Table 1.

Table 1 Production Constraints Causing the Lower Than Expected Yield

Rank	Constraints
1	Insufficient water
2	Damage by rats
3	Inadequate chemical fertilizer
4	Damage by pests and insects
5	Insufficient maintenance
6	Uneven leveling of parcel
7	Low-yielding rice variety
8	Inadequate land preparation
9	Other

It was found that water shortage was the most significant factor, the second was rats and then came the technological factors such as fertilizer.

Technological Factors

Since these factors can increase the rice yield, the farmers were asked whether they used these factors or not. The results are shown in Table 2.

The high yielding varieties of rice were used by all of the farmers sampled. The varieties most widely used were RD7

Table 2 The Percentage of Farmers Reporting Use and Non-use of Yield-increasing Factors (Modern Technology)

Type of Factor	Used		Did Not Use	
	No.	%	No.	%
High yielding variety	179	100	0	0
Chemical fertilizer	169	95	10	5
Pesticide & insecticide	94	53	85[1]	47
Weedicide	84	47	100[2]	53
Land preparation by mechanical power	176	98	3	2

[1] 32 farmers did not use pesticide and insecticide because there was no pest and insect damage to their rice.

[2] 43 farmers did not use weedicide because there was no problem with weeds.

and C4–63 which covered about 46% and 32% of the total planted area respectively. The other varieties were RD1 and RD3 which had been released earlier by the Rice Division, Department of Agriculture.

Chemical fertilizer was used by 95% of the farmers sampled. However, most farmers used very small amounts of fertilizer. On the average they used about 4.06 kg of nitrate and 4.93 kg of phosphate per rai. The average cost for pesticide and insecticide per rai was 7.58 baht.

Most farmers used them, however, after the pests and insects had already inflicted damage to their rice. As for weedicides, they cost 4.70 baht per rai and were used only when it appeared to affect the rice yield. Twenty nine percent of the farmers that did not use any weedicide in fact had rice fields with weed problems. It was found that only 40% of the farmers had good land preparation and 60% of them reported having difficulty in land preparation: 49% had fairly good land preparation and 11% had rather poor land preparation. It is interesting to observe that the use of mechanical power, a kind of new technology, has been widely and rapidly adopted by farmers in the Central Plain. In our study, 98% of the sample farmers used tractors to prepare their land and only 2% still used animal power (swamp buffalo) to prepare their land. Most tractors used were of the two-wheel type with less than 15 horsepower.

III Socio-economic Constraints on Adoption of Modern Techniques

Relative Importance of Socio-economic Factors

Table 3 reveals the socio-economic reasons why the farmers did not use modern technology including high yielding varieties, chemical fertilizer, pesticides and insecticides, weedicides, and good land preparation. The most common reason for not using modern technology was economic. The farmers lacked capital to invest in such modern inputs or did

Table 3 Percentage of Farmers Who for Socio-economic Reasons Did Not Use Modern Technology

Reasons \ Technology	High Yielding Varieties[1]	Chemical Fertilizer		Pesticides & Insecticides	Weedicides	Good Land Preparation
		Did Not Use	Used Small Amounts			
Economic	0	50	46	13	19	45
Risk	0	10	14	10	2	0
No supplies	0	0	0	0	0	1
Traditional	0	10	0	7	12	0
Do not want to be in debt	0	0	8	4	5	0
Belief	0	0	3	4	42	0
Physical	0	20	21	4	0	21
Lack of knowledge	0	10	6	45	19	7
Other	0	0	2	13	2	26

[1] All sample farmers used high yielding varieties.

not think that it would pay to use them. The next important reason was to avoid risk in using modern technology. The third was the lack of know-how concerning modern technology. The latter has a deep implication for extension services, which could offer more realistic and continuous training programs to farmers to overcome the difficulties.

The Role of Experimental Plots in the Adoption of Modern Techniques

An important reason for differences in the adoption of modern techniques among the farmers is their relation to experimental plots. As was mentioned in the methodology section, the farmers were divided into three groups with regards to their relation to experimental plots. The t-test was applied to see whether there was any significant difference among the three groups in the adoption of a specific aspect of modern agricultural technology such as high-yielding varieties of rice and fertilizer.

High-yielding varieties of rice were 100% accepted. They were introduced in late 1969 and have spread quickly throughout the country, particularly in the Central Plain where the irrigation system is fairly good. It was no surprise that there was no farmer in the area studied who did not adopt it. As for chemical fertilizers, it was found that farmers with experimental plots used 6.54 kg of nitrate per rai and 5.81 kg of phosphate, and farmers adjacent or close to experimental plots used 5.38 kg of nitrate per rai and 6.13 kg of phosphate per rai. The use of chemical fertilizer by these groups was not notably different. The third group used 3.72 kg of nitrate per rai and 4.38 kg of phosphate per rai. The use of nitrate by the third group was markedly different from that by the first group but not for the use of phosphate. The average cost of the chemical fertilizer per rai for these three groups were 115.75 baht, 105.45 baht, and 87.20 baht, respectively. There was a substantial dif-

Comparison	Amount of Nitrate (kg/rai)		Amount of Phosphate (kg/rai)		Fertilizer Cost (฿/rai)	
	Difference	T-value	Difference	T-value	Difference	T-value
Farmers with experimental plots vs. Farmers adjacent to experimental plots	1.16	1.37^{ns}	0.32	0.33^{ns}	10.33	0.72^{ns}
Farmers with experimental plots vs. Farmers far from experimental plots	2.54	3.06**	0.66	0.75^{ns}	28.58	2.01*

ns = not significantly different
* = significantly different at 95%
** = significantly different at 99%

Table 5 The Percentage of Farmers Applying Pesticides and Insecticides at Different Times

Timing of Application	Farmer Groups			Average
	With Experimental Plots	Adjacent to Experimental Plots	Far from Experimental Plots	
Application before insect damage	22	18	15	17
Application after insect damage	56	64	73	68
Application before and after insect damage	22	18	12	15
Total	100	100	100	100

ference in the fertilizer cost per rai between farmers with experimental plots and farmers living far from experimental plots. The results of the test are shown in Table 4.

Regarding the use of pesticides and insecticides, it was found that 69% of the farmers had pest and insect problems but only 53% of them used pesticides and insecticides. It is interesting to note that among the three groups the timing and amount of usage are different, as is shown in Table 5.

It was observed that most farmers applied pesticides and insecticides only after the damage occurred. The most appropriate application is before and after the occurrence of damage. About 22% of the farmers with experimental plots, among the three groups, reported adoption of this proper method and the least reported were by the farmers who lived far from the experimental plots. It can be concluded that closeness to experimental plots is necessary for the farmers to learn and adopt the proper techniques.

The cost of using pesticides and insecticides per rai among the three groups was 4.65 baht, 12.73 baht, and 5.05 baht. However, the difference in cost per rai was notably higher for farmers with experimental plots than farmers adjacent to experimental plots but was not significant between farmers with experimental plots and farmers far from experimental plots. See Table 6.

Table 6 The Difference in Cost per Rai of Pesticides and Insecticides Used by the Three Farmer Groups

Comparison	Difference	T-value
Farmers with experimental plots vs. Farmers adjacent to experimental plots	8.10	2.10*
Farmers with experimental plots vs. Farmers far from experimental plots	0.40	0.19ns

ns=not significant
*=significantly different at 95%

It was discovered that the weed problem was the least severe for the group with experimental plots but was very severe for the group far from experimental plots. However, the farmers adjacent to experimental plots incurred the highest cost per rai in using weedicides, 6.60 baht, followed

Table 7 The Difference in Cost per Rai of Weedicides Used and the Difference in Labor Used for Weeding

Comparison	Weedicide Cost per Rai		Labor Used in Weeding per Rai	
	Difference	T-value	Difference	T-value
Farmers with experimental plots vs. Farmers adjacent to experimental plots	5.02	2.08*	0.37	1.85*
Farmers with experimental plots vs. Farmers far from experimental plots	2.61	2.54**	0.73	2.92**

*=significantly different at 90%
**=significantly different at 99%

by the farmers far from experimental plots, 4.19 baht, and finally the farmers with experimental plots, 1.58 baht. In addition to using weedicides, the farmers reported using manual weeding, and the amount of labor per rai of these three groups was 1.44 days, 1.08 days and 0.71 days. The statistical test for differences in using weedicides and manual weeding is shown in Table 7.

It may be observed that weedicides were applied, despite the high cost involved, whenever weeds seriously affected the rice yield.

The adoption of mechanical power, especially small tractors, has been rapid. It was found that 98% of the farmers sampled used tractors and only 2% used buffaloes to plough and puddle the land. This two percent of farmers belonged to the third group who lived far from experimental plots.

Conclusion

About nine production constraints were reported to have caused the rice yield to be lower than expected. Most of these constraints are related to the inadequate use of modern technology to increase rice yield. Though the majority of farmers reported using modern inputs, the amount used was too small to have a significant effect on the yield. The common reasons for not using these inputs at all or using only small amounts of them were economic, aversion of risk, and lack of knowledge. The implication is that the training program for the farmers concerning the use of modern technology must be strengthened. With sufficient knowledge and comprehension of this new technology, the farmers will be able to make better decisions in assuming the risk of using those inputs and in seeking the capital for the necessary investments.

References

1. Thailand, Agricultural Economics Division. 1977. *Important Economic Information in Agriculture.* Ministry of Agriculture and Cooperatives. (in Thai)
2. Thailand, Siam Bulletin. 1977. *Domestic Economic News* 2 (19).
3. Thailand, Technical Division. 1975. *Rice Production and Fertilizer Use in Thailand.* Rice Department, Ministry of Agriculture and Cooperatives. (in Thai)